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some reason must be sought for the large number other than mere coincidence or the fact that the area is not forested. A further feature of interest in connection with the fall is the fact that it occurred at the time of the Leonid showers. Only two such instances have hitherto occurred within this period, these two being the falls of Werchne Tschirskaja and Trenzano. These are both veined spherical chondrites and the present indications are that Saline Township belongs in the same category.

OLIVER C. FARRINGTON.

NOTES ON THE LAFAYETTE AND COLUMBIA FORMATIONS AND SOME OF THEIR BOTANICAL FEATURES.

HAVING spent considerable time during the past two years in making a critical study of the flora of Georgia in all its aspects, I have been investigating, among other things, the influence of geological conditions on the present distribution of species. The most striking relations between geology and existing flora have been observed in the coastal plain, and I have restricted my explorations chiefly to that part of the state in order to study the interesting problems there presented.

The existing knowledge of the areal geology of the coastal plain is much less complete in Georgia than in the adjacent states, partly because the energies of the State Geological Survey have hitherto been necessarily devoted mostly to the investigation of mineral resources and other questions of more immediate economic importance, and partly because Georgia has for many years been singularly neglected by geologists and other scientific people. This state of affairs has been a source of considerable difficulty in the prosecution of my work, and has led me to undertake some geological investigations on my own account, most of those on which these notes are based having been made during the summer of 1901.

My geological observations have thus far been mostly confined to the Lafayette and Columbia formations, which as they cover almost the entire surface of the coastal plain are the most easily accessible, and at the same

time are quite readily recognized even by an amateur like myself. My knowledge of these formations, aside from my work in the field, has been chiefly derived from Mr. W. J. McGee's monograph in the Twelfth Annual Report of the U. S. Geological Survey, and from consultation and correspondence with Mr. McGee himself; and it was at his suggestion that I undertook to prepare these notes for publication.

In addition to the ordinary way of studying geological formations by their exposures in natural or artificial excavations, I have employed in the case of the Lafayette and Columbia, with very satisfactory results, another method which has perhaps never before been utilized to any considerable extent. This method consists in identifying the formations by means of the plants growing upon them. Early in the course of my investigations I noticed that certain species of herbaceous plants seemed to occur only on the Columbia sands, and that it made considerable difference in the distribution of some other species, especially trees, whether the Lafayette clays were present beneath the Columbia or not. I then used these species as an index in determining the formations when the regular method could not be used for lack of suitable exposures or when traveling by rail. This method should not be depended upon altogether, but when used with due caution it is very helpful.

I will mention here some of the more conspicuous plants which have served thus to indicate the formations, and would suggest that it would be advisable for every geologist who studies the Lafayette and Columbia formations in the southeastern states to familiarize himself with as many of these plants as possible.

The best indicator of the Columbia formation which has come under my observation is *Eriogonum tomentosum*, a plant which when in flower, in late summer, grows three or four feet tall and is conspicuous and unmistakable. It ranges from South Carolina to Florida and Alabama, and is widely distributed in the coastal plain, extending up to its inner margin at altitudes of six hundred feet or more,

but perhaps not found in the immediate vicinity of the coast. It seems to be strictly confined to the Columbia sands, and is most abundant where this formation is thickest and driest. *Frælicia Floridana*, a plant nearly as conspicuous but less abundant, seems to have a similar distribution in the coastal plain, though the same or a closely related species is found also on the plains of the Middle West.

Other species occurring in Georgia, apparently confined to the Columbia formation (with or without Lafayette beneath it), and large enough to be recognized from a moving train, are *Actinospermum angustifolium*, *Asclepias humistrata*, *Baptisia perfoliata*, *Chrysobalanus oblongifolius*, *Clinopodium coccineum*, *Croton argyranthemus*, *Dicerandra linearifolia*, *D. odoratissima*, *Kuhnistera pinnata*, *Nolina Georgiana*, *Paronychia herniarioides*, *Sarracenia flava*, and *Serenoa serrulata*, besides a host of smaller species. *Sarracenia flava* (the yellow pitcher-plant), like a few others, is occasionally found outside of the coastal plain, but within that region seems to be confined to the Columbia formation. It is a very conspicuous plant when growing in large colonies, and can be recognized at a considerable distance. The two *Dicerandas* (belonging to the mint family) can sometimes be recognized by their odors alone, and might therefore be useful in traveling at night. Their flowers are autumnal.

*Berlandiera tomentosa*, *Crataegus æstivalis* (the well-known 'May-haw' of Southwest Georgia), *Dichromena latifolia*, and doubtless several other species, seem to be confined to the Lafayette, with or without a thin overlying layer of Columbia, though this relation is much more difficult to determine than that between the Columbia and its vegetation, and the chances of error are consequently greater.

I do not recall at present any species which grows only on the exposed surface of the Lafayette, where the Columbia is absent, but there are probably some which are thus restricted in habitat. There are, however, quite a number of species in the coastal plain which seem to occur never where the Lafayette is present, but only on the Columbia or on out-

crops of the older underlying strata. Among these are *Bumelia lanuginosa*, *Dichromena colorata*, *Erythrina herbacea*, *Hydrangea quercifolia*, *Melanthera hastata*, *Taxodium distichum* and *Yeatesia lætevirens*, not to mention a number of species, especially ferns, which grow usually or exclusively on limestone and could not exist on the Lafayette clay.

Lastly, *Oxypolis filiformis* and *Taxodium imbricarium* seem to indicate the simultaneous occurrence of both Lafayette and Columbia.

The relations of the two *Taxodiums* (cypresses) to the geological formations are more fully discussed in a paper published in the *Bulletin of the Torrey Botanical Club* for June, 1902 (pp. 383-399). These two trees, together with the herbaceous species in the group first mentioned, are the principal plants which have been used in my investigations.

It would be impracticable to give here a detailed account of my observations on the Lafayette and Columbia formations and their distribution in Georgia, but I may do so at another time and place. I will mention, however, that I have already made notes on them in about forty of the seventy counties lying wholly or partly in the coastal plain of Georgia, and have found the above-mentioned botanical relations to hold true wherever it has been possible to verify them. The Columbia seems to vary little in composition and appearance throughout this region, though differing considerably in thickness and mode of occurrence in different parts of Georgia. The Lafayette, on the other hand, seems to vary more in appearance than in mode of occurrence. The two formations are very distinct in Georgia, however much they may appear to intergrade elsewhere. In many railroad cuts in the southeastern part of the state it is possible to locate the line of contact between them within an inch or two.

The term Columbia is of course applied here to the superficial layer of light-colored sand which covers so large a part of the pine-barren region, and differs in some respects from this formation as represented at its type-locality; this geographical variation being analogous to that exhibited by so many species of

plants and animals and often affording a basis for specific distinctions.

In the late Dr. Charles Mohr's 'Plant Life of Alabama,'\* which deals more exhaustively with geological features than any state flora previously published, these superficial sands are designated as 'Ozark sands' (doubtless named for Ozark, Ala.), a term which I have not seen used elsewhere. This formation is only mentioned three or four times in the work, however; so Dr. Mohr perhaps failed to perceive its important bearing on the distribution of the flora. If the 'Ozark sands' should ever be regarded as distinct from the typical Columbia, the superficial sands of South Georgia would of course be classed with them.

On my travels during the past summer frequent use was made of Mr. McGee's map (accompanying his monograph already mentioned) of the areal distribution of the Lafayette and Columbia formations, which I found to be remarkably accurate (in Georgia, at least), considering the small scale on which it is drawn and the large amount of territory covered by its author. Most of the discrepancies between the map and the observed conditions were naturally found in those regions never explored by Mr. McGee or any other geologist.

With a good series of maps, especially topographic maps, of the southeastern coastal plain it would not be difficult to trace with considerable accuracy the areas covered by the Lafayette and Columbia formations, but no topographic maps of any considerable portion of the coastal plain of Georgia have yet been made, and the data for them are as yet very meager. It is not even possible to get level notes from all the railroads in South Georgia, and the same condition doubtless exists in the corresponding portions of the adjoining states.

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INSTINCT IN SONG BIRDS. METHOD OF BREEDING  
IN HAND-REARED ROBINS (*MERULA*  
*MIGRATORIA*).

ON June 17, 1902, a pair of robins (*Merula migratoria*) confined in a large room with some

\* 'Contr. U. S. Nat. Herb.,' Vol. 6, 1901.

hundred and fifty other birds, of various sorts, hatched eggs which had been laid for some twelve days. This pair of robins were birds about four years old, and were what are known as hand-reared birds. I had taken them when very young from wild parents and raised them by hand.

On examining the nest after the second day I found there was only one young bird. It appeared to be perfectly healthy and normal, and so matters went on until the fourth day. On the morning of the fourth day I found the young robin had disappeared from the nest, but the female bird was still brooding. It now occurred to me to substitute two wild young, rather older, from a nest of robins that had been hatched out of doors in the yard. I introduced these two young birds to the parent birds, with some remonstrance on their part, but within five minutes of the time when I placed them in the nest the old birds were feeding them, and were apparently as solicitous for them as if they had been their own. At the close of the day, the substitution having been accomplished early, and I having watched the birds closely, it appeared to me that only one of the two young birds was being fed, and I took the other from the nest to rear it by hand.

Both young birds are now going about, beginning to fly, learning to eat unaided, etc., I feeding one, and the male parent robin feeding the other.

The following comments suggest themselves to me:

To go back in the history of the parent birds, they were birds that were taken from a nest in May, 1898, and were naked and blind, probably not more than three days old when adopted. The usual method of procedure which I have employed in rearing wild birds by hand is to take an entire brood and nest, and keeping the young birds as undisturbed as possible, to do practically as near what the old birds do as is attainable.

It is unnecessary to suggest that the parent birds I am speaking of are healthy and vigorous, because the very fact that they have bred in captivity seems to determine this. A word seems essential to their method of nest-build-